

CLAIMS:

1. A mass/solution polymerization process utilizing a functionalized rubber to produce a rubber modified polymer from a vinyl aromatic monomer comprising polymerizing the vinyl aromatic monomer in the presence of a rubber, wherein the rubber comprises a functionalized diene rubber having:

- a) a solution viscosity of less than 50 centipoise (cps), and
- b) at least one functional group per rubber molecule which enables controlled radical polymerization;

such that grafted rubber particles are formed and dispersed within a matrix comprising polymerized vinyl aromatic monomer.

2. The process of Claim 1 wherein the vinyl aromatic monomer is styrene.

3. The process of Claim 1 wherein the vinyl aromatic monomer is copolymerized with acrylonitrile.

4. The process of Claim 1 wherein the functionalized diene rubber is a styrene/butadiene block copolymer rubber.

5. The process of Claim 1 wherein the functionalized diene rubber has a solution viscosity of 5 weight percent in styrene at 20°C of less than 45 cps.

6. The process of Claim 1 wherein the functionalized diene rubber contains a functional group capable of forming a stable free radical.

7. The process of Claim 6 wherein the functionalized diene rubber contains a nitroxide functional group.

8. The process of Claim 6 wherein the functionalized diene rubber contains a functional group selected from 2,2,6,6,-tetramethyl-1-piperidinyloxy (TEMPO); 2,2,6,6-tetramethyl-1-[1-[4-(oxiranylmethoxy)phenyl]ethoxy]-piperidine; or 3,3,8,8,10,10-hexamethyl-9-[1-[4-(oxiranylmethoxy)phenyl]ethoxy]-1,5-dioxo-9-azaspiro[5.5]undecane.

9. The process of Claim 1 wherein the functionalized diene rubber contains a functional group capable of atom transfer radical polymerization.

10. The process of Claim 1 wherein the functionalized diene rubber contains a functional group capable of reversible addition-fragmentation chain transfer polymerization.

11. The process of Claim 1 wherein the polymerization is conducted in the presence of a chain transfer agent.

12. The process of claim 1 wherein the polymerization is conducted in the presence of an initiator.

13. The process of claim 1 wherein the polymerization is conducted in the presence of an initiator and a chain transfer agent.

5 14. The process of claim 1 wherein a bimodal rubber particle size is obtained by utilizing the process of Claim 1 to produce each particle size in a separate reactor, combining both reactor streams and continuing the polymerization.

10 15. The process of Claim 1 wherein the mass polymerization is conducted under conditions sufficient to form a partially polymerized continuous phase containing polymer and discrete particles of highly grafted rubber having a specific volume average diameter from a first rubber-containing mixture; a second rubber-containing mixture is subsequently admixed with the partially polymerized feed under conditions such that the previously formed rubber particles remain dispersed throughout the continuous polymer phase; and the newly added rubber is dispersed as discrete particles having a second volume average
15 diameter.

16. The process of Claim 15 wherein the second rubber-containing mixture is a different composition than the first rubber-containing mixture.

17. The process of Claim 1 wherein a portion of a partially polymerized feed is recirculated to an earlier polymerization stage.

20 18. The rubber modified polymer produced by the process of Claim 1.

19. An article or composition comprising the rubber modified polymer of Claim 18.